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Research productivity at public universities: Evidence from Morocco

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Abstract:

The main objective of our article is to analyze research productivity at Moroccan public universities. This study contributes to the rare literature that exists about African research productivity in general and research at Moroccan public universities especially.
Research production of Moroccan public universities in 2018 represents 85.26 % of total Moroccan scientific production which makes this study important.
Our study focuses on the period 2008 to 2018, we use the most recent available data and we include all Moroccan public universities. We use bibliometrics indicators in order to evaluate research at Moroccan public universities.
We use the number of publications per professor to analyze professor productivity and the number of citations to measures how a paper has contributed to research and science, those indicators have some imperfections but are generally accepted by the scientific community.
The results of our study indicate that research productivity at Moroccan public universities is low, but it's slightly improving over the years.
The citation of published Moroccan papers is improving, and the articles published in the 100 best Scopus journals are better citer than those published by comparable countries like Algeria and Tunisia, which means that Moroccan research has a potential for development.
The teaching pressure, the funding research system, and the promotion of the human resource policy can be an explanation. To improve research productivity of Moroccan public universities, we propose some recommendations like the reform of the promotion system, the introduction of financial and non-financial initiatives and the simplification of the funding circuit of research projects and publications.

Keywords: Research productivity, Public universities, Publications, Morocco
JEL Classification: H52, I23, I28
Paper type: Empirical research

1. Introduction:

Recently special attention is given to scientific research; the latest pandemic of coronavirus has emphases this tendency. Many researchers from developed countries like the United States, Germany, and France are massively working to develop a vaccine that can save lives around the world, but a lot of other developing countries like Morocco are just waiting, because their research system, their human capital knowledge cannot achieve this level of advanced research.

In Morocco, interest in research was late compared to teaching in higher education; the first public research budget was allocated in 1993, by contrast, the first modern university was created in 1959.

After independence, Moroccan authorities were mainly concentrated on education, the objective was to teach and train Moroccan human capital that can easily replace French workers in public administrations, universities, and companies; this can be an explanation of the late interest in research. Otherwise, there is also a perception that in less developed countries universities must concentrate on developing and improving teaching, not in research activities (Altbach, 2015; Schiller & Liefner, 2006) (How can we speak about research, if we are still suffering from analphabetism, and less competent workers, it's a matter of priorities and budget management).

Others think that research and teaching are contradictory functions, it means that we cannot develop the two at the same time, and less developed countries must focus on teaching. Also, research activities need financial and human resources that those countries don't have, so it's more optimal to invest in teaching to achieve a better return on investment. However, studies demonstrate that research activity contributes to the growth of nations (Carayol & Matt, 2006) and boost competitiveness, and innovation (Altbach et al., 2009) research publication also improve the higher education system reputation and stimulates modernization and innovation(Dhillon et al., 2015).

Research productivity is generally measured by the number of publications by full professors, publishing is not a simple process, it is a rigorous and serious process; the publication of scientific research is conditioned by reviewers evaluation who assess their quality and originality; which means that a university professor who is doing research activity has a minimum required competencies, then by doing research these competencies will improve and probably that will impact positively the quality of his teaching .The contradiction that some authors discuss is the time, resource, and energy allocation; those three resources will split in two activities : teaching and research instead of one.

Research in Morocco is mainly financed by the government, the majority of research input and output are related to public universities. But those universities are accused of very low research productivity. The last data indicates that a university professor publish one article in two years, and 53% of professors did not publish any article between 2014 and 2018. Therefore, we consider it very important to study research productivity of Moroccan public universities.

The originality of this work is triple, first of all, this is the first article interested in research at Moroccan public universities, secondly, the analyses will include all branches of science not only hard science like other studies did, thirdly, we use the most recent available data.

Our study adds knowledge about research productivity in public universities generally and especially about African countries research systems like Morocco. We aim in this article to answer the following questions:

How is the productivity of research in Moroccan public universities? How can we explain this productivity? What influences research productivity in Moroccan universities? How is the performance of research in Morocco compared to other MENA countries?

This paper is organized as follows; the first section describes public Moroccon universities and research system, section 2 presents the literature review related to the subject, while section 3 describes the methodology and data; section 4 presents the results and discussion, the last

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section concludes the work by proposing some recommendation to improve research at Moroccan public universities.

2. Public Universities and Moroccan Research System

Morocco invests 0.8% of his GDP in research and development, the government fixed as objective 1% of GDP for the year 2020, but they could not achieve it. Also, African unions in which Morocco is a member required 1% investment in Research and development to ensure the sustainable development of the continent. The comparison with other African countries like Egypt (0.72%GDP), Tunisia (0.63% of GDP), and Algeria (01% of GDP) demonstrates that Morocco devotes more resources to research, more developed countries like the United States and France, invest more than 2% of their GDP in research.

There are currently 12 public universities in Morocco and one other public university with a private management system. Moroccan universities play a central role in higher education and in the national research system; Approximately 78.4% of students in higher education are studying in public universities, only 14.3 % are enrolling in the private sector. The public universities present the advantage of being free, and their diplomas are recognized by the state, but they also suffer from a lot of problems like massification; for instance, the number of university professors increased by 33% between 2001 and 2016, During the same period, the acceleration of a student's number was five times faster (187%).

This massification influence negatively research and specifically doctoral students, the data shows that 9 of doctoral students out of 10 drops out and the graduation rate is only 6%.

In addition, Professors in Morocco have no incentive for supervision doctorate students,' unlike some countries like France, furthermore, research activity is less valued in the career of university professors.

Research in universities is generally the activity of professors and Ph.D. students, almost 70% of researchers in Morocco are working at universities, research production at universities in 2018 represents 85.26 % of total Moroccan scientific production, private sector and other public institutions produce only 15.4% of total scientific production.

That data indicates clearly that research production in Morocco is dependent on public universities, which means that to understand and evaluate the Moroccan research system, we must concentrate on studying public universities.

3. Literature review

Many studies have assessed the performance of research in general and the performance of research in public universities specifically, but a few ones were interested in studying research performance in African countries and rare one in Morocco

3.1. The productivity of Moroccan research system

(Bouabid & Martin, 2009) have evaluated Moroccan research using-bibliometric indicators over the period 1997–2006, the authors excluded social sciences, humanities, and arts from their evaluation. Authors found that Moroccan researchers publish an average one article every seven years. This low productivity was explained principally by three parameters; the age, the language, and the promotion system. Authors concluded that researchers become less productive with age, also the publication in French language doesn't promote Moroccan research because the majority of indexed journals are in English, the promotion system also disadvantages researchers who are more involved in research activity.

(Medina, 2015) analyzed Moroccan research productivity over the period 1996 to 2012, the author compared Moroccan research productivity with some African countries and evaluated the impact of government decisions on this productivity. Fida thinks that the decrease of

Moroccan scientific researchers output during the early and mid-2000 is due to the negative impact of some government decisions.

(Rhassate et al., 2018), analyzed the Moroccan scientific production using-bibliometric indicators. The authors specify their studies in the area of computer science. The result of their studies showed that Morocco has fallen two places during the last ten years, for the authors to improve Moroccan scientific publications; the country must encourage other sources of funding based on international partnerships and cooperation.

3.2. Research Productivity in International Studies

(Dundar & Lewis, 1998)tried to answer the following question: what determines research productivity in the United States Higher education? Authors build a general statistical model to explain research productivity, the results of the models suggest that Having a high percentage of faculty members, more infrastructure and more financial resources influence positively research productivity. Authors also found that private universities are more productive than public ones.

(Carayol & Matt, 2006) analyzed individual and collective determinants of scientific productivity in Louis Pasteur University, authors found that academic position, promotion, quality, and intensity of colleagues' publication impact positively the scientific productivity.

(Chen, 2010), studied research productivity in 367 United States accounting faculties. Authors examine thirteen motivations that could impact research productivity, the article concluded that most important outcomes are receiving tenure, being promoted, getting pay raises, and staying in the field.

(Lakitan et al., 2012) have studied the scientific productivity of Indonesian universities and public R&D institutions, the authors used scientific publications as a proxy for productivity. They conclude that scientific productivity of universities and public R&D institutions is considerably low, but a notable increase was remarked due to favorable government policies and financial incentives.

(Dhillon et al., 2015) investigate via a descriptive survey the influence of personal, environmental and behavioral factors on research productivity at Malaysian public university. Authors found that researcher experience and academic position are the most influenced variable, but other environmental and behavioral factors like research funding and academic attitude are also important.

(Sahoo et al., 2017)Examined research Productivity in Indian management Schools via a composite indicator over the period 1968- 2014. Principal findings of the article are: similar productivity of public and private schools, faculty members who had a foreign doctoral degree are more productive.

(Fursov et al., 2016) try to find the individual determinants of research productivity in Russia. Authors used the number of publications to measure productivity, but they extended their data to different sources not only those internationally reorganized like Scopus or web of science. Authors took into consideration publication in the Russian language, not only English ones.

(Barletta et al., 2017), studied scientific productivity and transfer activities in Argentinean ICT research groups. The results of the study show that scientific productivity is positively related to the proportion of PhD holders, the linkages with other institutions for R & D and the funding coming from national scientific institutions. Those results not only suggest the absence of the linear model of innovation, but the existence of a completely opposite relationship: scientific productivity is negatively associated with groups technological performance.

(Nafukho et al., 2019)investigated research productivity of 17 leading public universities in Kenya using H-index. The analysis showed that the research productivity is influenced by individual characteristics (gender, rank, terminal degree, and experience) and institutional

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characteristics (number of undergraduate students enrolled, percentage of Ph.D students enrolled, and funding allocated for research activities).

(Jameel, Alaa S. and Ahmad, 2020) studied research productivity at Cihan University Erbil, an Iraqi public university via a survey. The results of the study indicated that Fund, Collaboration, ICT and Job Satisfaction had a positive and significant impact on Research Productivity.

4. Methodology and Data

4.1. Productivity via the number of publications:

The term productivity is usually defined as the processes of using efficiently inputs to maximize output. Output is research publication and inputs are professors, researchers, financial resources, and non-financial resources like books, access to specialized scientific journals, etc.

In the literature review, research productivity is measured (Abramo & D'Angelo, 2014; Barletta et al., 2017; Dundar & Lewis, 1998; Fursov et al., 2016; Leišytė, 2016; Sahoo et al., 2017; Toutkoushian et al., 2017) by the number of the publication of full professors; This indicator is generally accepted by the scientific community, but some authors considered it inappropriate.

Research publication is the principal method of knowledge dissemination and science progress, it's also easy to measure and the data is available for almost all countries.

Some authors consider using research publications as a unique indicator for assessing research productivity is misleading (Sahoo et al., 2017).

Also (Abramo & D'Angelo, 2014) think that the commonly used method to assess productivity is irrelevant, for the author's research evaluation must drive from microeconomics; bibliometrics is just counting of what it can count, not of what they must count. Research publications is also used in university ranking and in academic promotion; also, more countries are using it as a proxy for funding allocation which is not the case for Morocco.

Also, using the number of professors as the only indicators of inputs, could not be 100% relevant, but using all disponible inputs like financial budget, or time allocated is impossible, because the access of those data will not be always possible (time allocation for research for example), for this reason we think that research publication is an acceptable indicator to assess research productivity.

Then, in order to analyze research productivity in Moroccan public universities, we use the number of publications by professors.

Research productivity = Number of professor/ Number of publications

4.2. Citation: an indicator of the impact and or quality

The impact of an article measures how a paper has contributed to research and science progress, it also appreciates the influence of a paper on the research community, this impact is measured by the number of citations (Mingers & Leydesdorff, 2015), citation can also be a good indicator to evaluate the reputation of an author on his research filed(Sahoo et al., 2017).

The number of citations can also be an indirect measure of quality, a low-quality paper will not be cited. For (Mingers & Leydesdorff, 2015) every published paper has a minimum quality requirement, the fact of not being cited doesn't mean low quality but that could indicate that the paper is disconnected from the recent development of the field.

Considering a citation as an impact indicator is also criticized because the reasons of citations are not always proper, for example an article that is published in a well-repeated journal will probably more cited than this published in less repeated one, even if the value add of the second article is of more importance for research progress, also, sometimes an article is cited just because we know the authors and we know his publications. In addition, some journals who

fortunately are not well reputed ask submitted to cite a minimum number of two works from the journal publication in order to improve their citation, we can also add to the problem of self-citation. Besides these criticisms, citation give a good image of an article impact, and can also give an idea about his quality, that's why we consider using citation is helpful in our work.

4.3. Data

The data used in our study is gathered from different sources; meanly the higher education ministry website, the different report of Academic Hassan II of science and technic, the UNESCO statistics, barometer web site of scientific production in Morocco, and the last note of Moroccan University President's Symposium.

The Moroccan Barometer use Scopus data, because it presents the advantage of covering a large number of journals, and the availability of data for free(Toutkoushian et al., 2017) , Scopus also includes journals in all fields of science even arts and humanities. But his inconvenient that it only includes papers with English abstract (Toutkoushian et al., 2017) which can represent an issue for a real evaluation of research productivity in Morocco, especially if we know that teaching in higher education is generally in French for the scientific field and in Arabic for humanities; that's what can explain the majority of research publications are in Arabic or in French language, also Scopus is criticized because it doesn't include citation from books and websites for example(Sahoo et al., 2017).

Moreover, the innovation of this work is the evaluation of all Moroccan public universities research, and all fields of science, even arts and humanities. Which gives a global and clear vision on the research situation at Moroccan public universities.

5. Results and Discussion

During the period 2015/2018 research production of Moroccan public universities presents more than 82% of total Moroccan research production, research production of all other public or private operators represents less than 18%. That data indicates that Moroccan research production is dependent on public universities production, but that also illustrates the importance of public universities research on the development of the country (table 1)

Table 1. *The importance of universities research production in Morocco*

Year	**2015**	**2016**	**2017**	**2018**
Moroccan scientific production	4899	6035	6912	7512
Universities research production / Moroccan research production	82.67	85.07	85.40	85.26

***Source**: note of Moroccan University Presidents Symposium*

5.1. The evolution of public universities research production

Research production at public universities is increasing over the period of the study (2008 to 2018). For example, during the year 2008 research production of all public universities was 1677, during the year 2009, research production was growing by 18%, the number of articles produced was 1978 articles, during 2014 the number of articles produced was 4543, it means that research production was doubled compared to 2009, during the year 2018, public universities produced 7295 Article.

The ranking of universities on the basis of total research production, indicates that most productive university is UM5 university with 13270 articles, followed by UH2C, with 6059 articles, then the UCAM university with 5814 articles.

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The most ranked universities in research are generally the oldest one in Morocco; which can be explained by the accumulation of experience in research; the oldest universities have more experience in research than the recent created ones. But we also observe that some recently created universities like UIC university outperform some oldest universities like UMP and UIZ, which means that those universities capital more in their research experience, and maybe encourage more their researcher for publishing.

5.2. Research Productivity

Research productivity of Moroccan public universities over the period 2008-2018 is low, but it's slightly improving over the years. During the period 2008 to 2012, the productivity per professor was less than 0.25, it means that to publish one paper, a Moroccan University professor needs 4 years or more (table 2).

Table 2: *The average productivity of Moroccan public universities over the period 2008-2018*

Year	Productivity Average	Max	University With max productivity
2008	**0.14**	**0.29**	**UCAM**
2009	**0.15**	**0.3**	**UCAM**
2010	**0.17**	**0.33**	**UCAM**
2011	**0.19**	**0.35**	**UCAM**
2012	**0.25**	**0.5**	**UIT**
2013	**0.24**	**0.45**	**UIT**
2014	**0.28**	**0.51**	**UIT**
2015	**0.37**	**0.66**	**UM5**
2016	**0.46**	**0.82**	**UIT**
2017	**0.50**	**0.94**	**UIT**
2018	**0.50**	**0.94**	**UIT**

Source: *Authors based on national barometer data*[1]

Productivity has increased to 0.50 per year between 2017 and 2018, which means that to publish an article Moroccan public university professor needs an average two years. The most productive universities are UCAM, and UIT, who record the maximum productivity for more than four years. UIT has the most productive researchers with an average 0.94 during 2017 and 2018. The research productivity data of Moroccan public universities during the last 10 years, indicates that the low research productivity at Moroccan public universities is a structural phenomenon.

5.3. Impact and Quality

The evolution of Moroccan research publications on top Scopus journals over the period 2013-2017 indicates that the number of Moroccan high-quality publications vary from year to year, the number of publications is 13 in 2013, 21 publication in 2014, and 16 in 2017. The Total research publication in 100 best Scopus journals during the period of the study is 71 articles; the majority of these publications are in the field of medicine.

The number of citations and citation to the publication is increasing gradually; during 2013, the number of citations was 58, and citations per publication 4.46, during 2014 for less than the double of publication, the number of citations has increased approximately by 10, and citations per publication was 22.33. During the year 2017, the number of citations was 6425, and the citation per publication was 401.56; that data indicate that besides the low number of

[1] https://barometre.imist.ma/index.php?option=com_content&view=article&id=4&Itemid=107

publications in best Scopus journals, the citation of Moroccan publication is highly increasing, which indicates that the impact and the quality of Moroccan research is improving (table 3).

***Table 3** :publication in the 100 best Scopus journals from 2013 to 2017*

Year	Publication	Citation	Citation / Publication
2013	13	58	4.46
2014	21	469	22.33
2015	10	1298	129.8
2016	11	3526	320.54
2017	16	6425	401.56
Total	71	20140	283.66

***Source**: report on national scientific production s in comparison with other countries (CNRST-IMIST, 2019)*

The comparison with other comparable countries in the MENA zone like Tunisia and Algeria permits to understand and evaluate better research system in Morocco especially if we compare different inputs and outputs.

The number of researchers by millions of populations in Morocco is 1024, 1814 in Tunisia and 168 in Algeria. The number of publications is 71536 for Morocco, 94962 in Tunisia, and 74802 in Algeria. That data indicate that Tunisia produces more research and has more researchers, but with less researcher than Morocco, Algeria produce more research, which indicates the low productivity of Moroccan researchers.

The number of citations is 840209, and citations per document are 8.85 for Tunisia, For Morocco the number of citations is 623082, and citations per document are 8.71. The number of citations is 569227, and the citation per document is 7.61 for Algeria. The citation data indicate that the Tunisian research has more impact than Morocco and Algeria, but with less research production, Moroccan research has better impact than Algeria. Expenditures on research and development are higher in Morocco (0.8%) than Tunisia (0.7%) and Algeria (0.1%).

That data approve the problem of productivity at Moroccan research generally and public universities specifically, but they also indicate a good impact of Moroccan research.

***Table 4** :comparison between Morocco and some MENA country in terms of output and Input*

		Inputs		Outputs	
Country	**Number of researchers/ million population**	**RD/GDP%**	**Number of publications**	**Citation**	**Citation per document**
Morocco	1024	0.8	71536	623082	8.71
Tunisia	1814	0.7	94962	840209	8.85
Algeria	168	0.1	74802	569227	7.61

***Source:** Authors based on CNRST and UNESCO data*

The impact of publications measured by the number of citations, indicates that the articles published by Moroccan researchers are better cited than those published by researchers in Algeria and Tunisia, with 283.66 citation per paper for Morocco, against 198.89 citation per paper for Algeria and 255.06 citation per paper for Tunisia (table 4).

Moroccan research has a potential for development since the articles published in the 100 best journals of Scopus are better cited than the countries of the sample (Tunisia and Algeria). However the number of publications remains low. As for the global share of publications in the

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100 best scientific journals, Morocco only presents 0.72 publications, while Tunisia's share is 0.79.

6. Conclusion and Recommendations

The main objective of this article is to analyze and evaluate research productivity in Moroccan public universities via some bibliometrics indicators as the number of publications and citations. The goal was to verify the idea that Moroccan university's research is low in terms of quantity and quality.

The data used in our research was mainly collected from the Moroccan barometer and some reports of Academic Hassan II of science and technic, and the UNESCO Institute of statistics

The main finding of this paper is that Moroccan research productivity at public universities is low, even if the number of publications is improving slightly. Besides that, their impact is better compared to similar countries like Algeria.

The low productivity of Moroccan public universities is a result of multiple factors; the pressure of teaching, the promotion system, the scientific language, and the research funding system.

In Moroccan public universities, the supervision rate is very high, one university professor supervises 57 students, on Tunisia this rate is just 14 and is 23 in Algeria, Moroccan university professors supervises the triple than Tunisian university professors and more than double than an Algerian professor, this pressure of teaching can be one of the factors that could explain the low research productivity at public universities; the literature confirms this hypothesis because it considered that teaching and research are two conflicting functions (Carayol & Matt, 2006; Leišytė, 2016)Moreover, The Moroccan public Human resource promotion system is deficient, in all public administration's promotion is based on seniority, not in productivity which discourages more productive people, also university promotion system does not encourage research, the same score is given to teaching and research, also after getting PES grade which is the top grade in Moroccan universities, no promotion can be awarded, which discourage more experienced professors; that's maybe what explains the fact that more than half of them did not publish anything between 2014 and 2018. We can also add, the absence of any type of initiation to encourage research activity, those initiation is very important in other countries like China and Russia for example who give the equivalent of a month's salary or more to researchers who published in well-indexed journals (Altbach, 2015).

Moreover, the scientific language in Morocco is French, that's why Moroccan researchers tend to publish in it, which affects the number of their publications in international journals who are generally in English (Bouabid & Martin, 2009).

The funding research system is also complex which causes delayed or abandoned projects and publications(Medina, 2015) in the majority of cases the budget exists, but due to bureaucracy and complexity, scientific and researchers cannot benefit from it, which is the case of our laboratory.

To improve research productivity at Moroccan public universities, we propose some recommendations (some of them will appear costly, but the last pandemic demonstrates that research and education must be a priority):

- The reform of the promotion system; the promotion system must be based on productivity not on seniority.
- Introduce financial and non-financial initiatives for more productive researchers
- Simplify the funding circuit of research projects and publications.

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Appendices:

Appendix 1: *University research production Over the period 2008*

Universities	Total research production Over the period 2008 to 2018	Ranking	Date of creation
UM5	13270	1	1957
UH2C	6059	2	1975
UCAM	5814	3	1978
USMBA	5100	4	1975
UIT	2956	5	1989
UMP	2805	6	1978
UMI	2301	7	1989
UIZ	2202	8	1984
UAE	2083	9	1989
UCD	1583	10	1985
UH1	1054	11	1997
USMS	965	12	2007

Source: elaborate by the authors based on national barometer data

Appendix 2: *ranking of Moroccan universities by productivity*

Ranking	University	Average Productivity
1	UIT	0.52
2	UCAM	0.39
3	USMBA	0.34
4	UMP	0.32
5	UCD	0.29
6	USMS	0.28
7	UM5	0.27
8	UH1	0.26
9	UMI	0.252
10	UIZ	0.25
11	UAE	0.23
12	UH2C	0.14

Source: *elaborate by the authors based on national barometer data*

Appendix 3: *list of university and institution included in study*

1. Abdelmalek Essadi-Tétouan University (UAE)
2. Cadi Ayyad University (UCAM)
3. Chouaib Doukkali University - El Jadida (UCD)
4. Hassan 1er University – Settat (UH1)
5. Hassan II University – Casablanca (UH2C)
6. Ibn Tofail Kenitra University (UIT)
7. Ibn Zohr University- Agadir (UIZ)
8. Mohammed Premier Oujda University (UMP)
9. Mohammed V University of Rabat (UM5)
10. Moulay Ismaïl University of Meknes (UMI)
11. National Center for Research and Technology (CNRST)
12. Sidi Mohamed Ben Abdellah-Fes University (USMBA:)
13. Sultan Moulay Slimane University of Beni Mellal (USMS)
14. The United Nations Educational, Scientific and Cultural Organization, (UNESCO)